

A Case of Carotid Rete Mirabile Associated with Basilar Tip Aneurysm

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Key words: basilar artery, aneurysm, carotid rete, anatomy

Summary

Carotid rete mirabile (CRM) is a rare condition consisting of a physiological network between the external and internal carotid arteries in lower vertebrates. Only a few cases have been reported in humans presenting as hemorrhagic or ischemic cerebrovascular disorder. We present a case of CRM presenting as an aneurysmal subarachnoid hemorrhage and discuss the embryologic, anatomic, hemodynamic and clinical significance of this rare entity.

Case Report

A 52-year-old woman presented with diffuse subarachnoid hemorrhage. The magnetic resonance angiogram revealed a basilar termination aneurysm. In addition, a network of vessels was noted around the cavernous sinuses bilaterally (figure 1).

Carotid angiography revealed hypoplastic internal carotid arteries (ICA) bilaterally in the neck (embryologic segment 1) (figures 2,3). An arterial network involving the horizontal portion of both the internal carotid arteries was demonstrated (embryologic segment 5). This network was fed through the branches of internal maxillary arteries. In addition the primitive maxillary artery was seen to feed the complex parasellar rete on the left side via right carotid injection (figures 4,5,6,7,8). The distal supraclinoid segments of both the internal carotid ar-

teries and the carotid termination were normal. Vertebrobasilar angiography confirmed the basilar termination aneurysm and opacified the entire circle of Willis. No occlusive disease was seen in the posterior circulation. The aneurysm was successively excluded from the circulation by endovascular coiling. The patient made an uneventful recovery and is well at two-year follow-up.

Discussion

Several circulatory adaptations in lower vertebrates prevent overheating of the brain and serve to regulate pressure and cerebral blood flow. These relate to changes in external heat and blood pressure. The flippers and tails of aquatic mammals and the feet of birds have rete mirabile in them where arteries and veins run next to each other and exchange heat in a counter-current fashion. Capillaries beneath our skin constrict and dilate in response to environmental temperature to conserve or dispel heat. Species from the Lamnidae family maintain their body temperature with the help of a vascular net (rete mirabile), which maintains the water temperature around their bodies. Similarly, the giraffe has a specialized network of carotid arteries (rete mirabile) that enable it to withstand the surges of blood that occur when the head is lowered and raised. This system allows the blood pressure to the brain to remain constant.

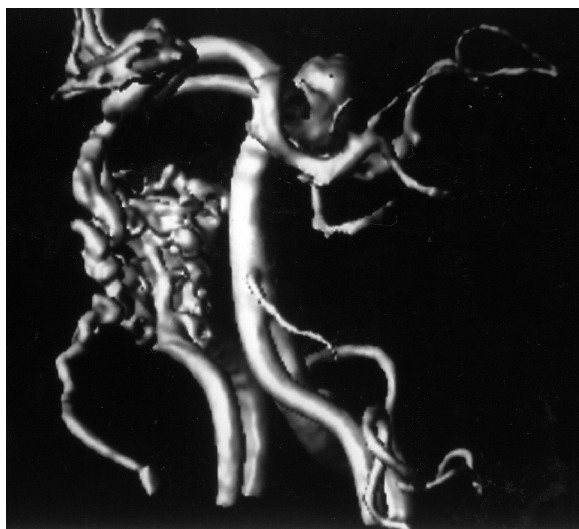


Figure 1 Time of flight MRA of circle of Willis demonstrating basilar termination aneurysm and bilateral rete appearance.

The occurrence of rete mirabile in humans is rare. Only a few cases have been reported in the literature. The first case to be reported was by Minagi and Newton in 1966 where a CRM existed in the cavernous portion of the internal carotid arteries bilaterally anastomosing richly with the branches of the internal maxillary artery¹. Recently, Mahadevan et Al.² reported a case of bilateral carotid and vertebral rete appearance in a western patient.

Cerebral ischemia and subarachnoid hemorrhage are the modes of clinical presentation of patients with rete appearance³. In the literature, five patients have presented with subarachnoid hemorrhage. Only one patient was found to have an aneurysm⁴. In that patient, a basilar artery aneurysm had ruptured. In the other cases, the origin of the SAH has not been defined but has been speculated to be due to vascular fragility and hemodynamic stress in the rete⁵.

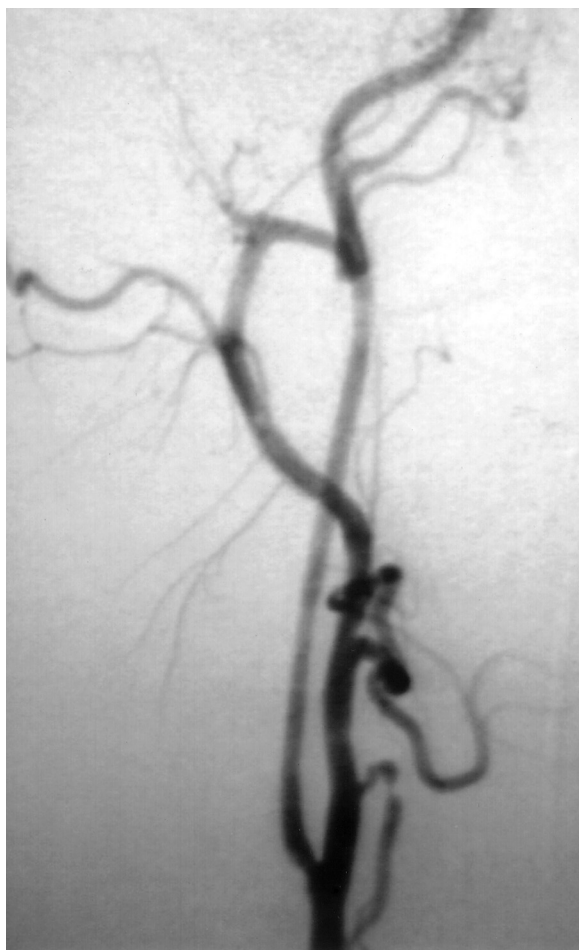


Figure 2,3 Right and left common carotid angiogram demonstrating hypoplastic internal carotid arteries in segment 1.

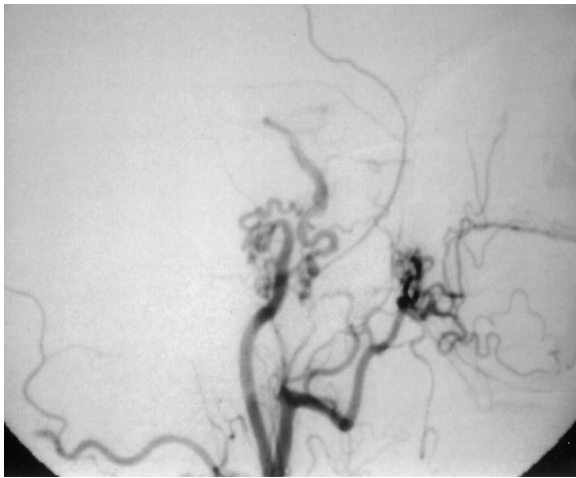


Figure 4 Right common carotid angiogram lateral view demonstrating agenesis of the proximal cavernous internal carotid artery with rete appearance.

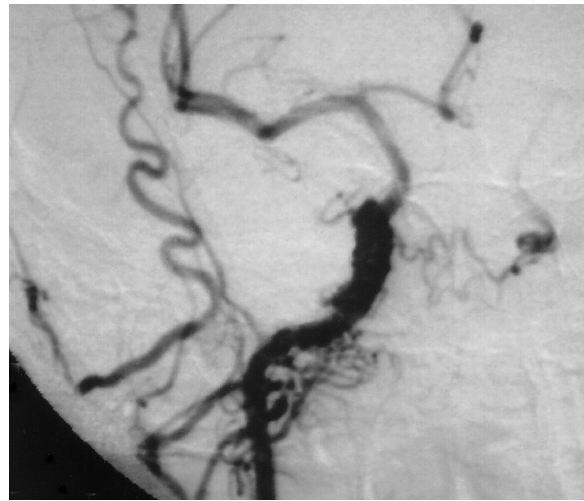


Figure 5 Right common carotid angiogram lateral view demonstrating trans-sellar anastomoses towards the left ICA.

In the case presented here, the clinical presentation was of subarachnoid hemorrhage following rupture of the basilar termination aneurysm. The basilar tip anatomy is of an asymmetric caudal fusion type, which has an increased predilection for aneurysm formation⁶. The hemodynamic stresses from increased flow via the basilar artery to supply the entire circle of Willis further exaggerate the risk of aneurysm rupture in this location.

According to the reported cases, CRM has characteristic angiographic findings³. These are: regular narrowing of the ICA from the carotid bifurcation, an arterial plexus between the internal maxillary artery and the cavernous



Figure 6 Left common carotid angiogram demonstrating agenesis of the proximal cavernous internal carotid artery with rete appearance.

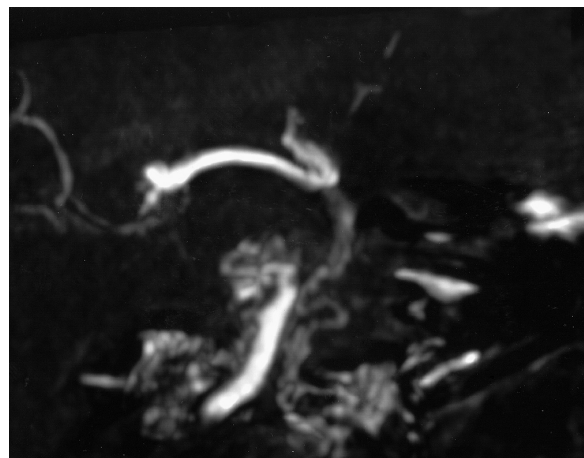
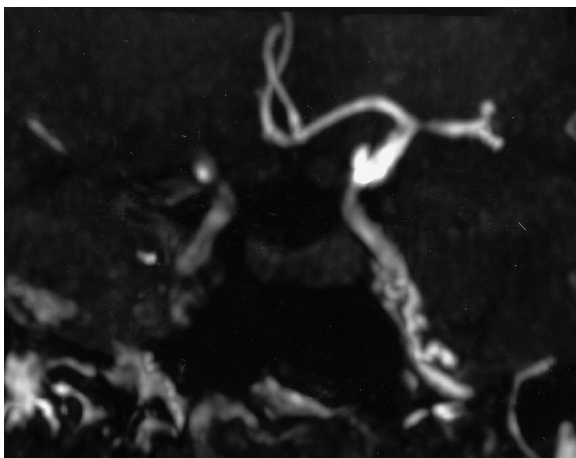


Figure 7,8 Source image from the MRA, maximum intensity projection shows the contribution from the internal maxillary artery towards the rete.

portion of the ICA⁷, dilation of the ophthalmic artery and anastomosis from the internal maxillary artery, the supraclinoid ICA is not hypoplastic and is fed by the arterial plexus and ophthalmic artery. These are bilateral lesions and there are no anastomosing vessels in the intradural portion.

The case illustrated here has the typical findings of a rete mirabile on angiography and on magnetic resonance angiography (MRA). The

agenesis affects segment five of the carotid arteries on both sides with the rete also fed via the maxillary artery branches.

Conclusions

A typical case of CRM is illustrated. The clinical presentation with subarachnoid hemorrhage is rare but as in this case an intradural cause for the hemorrhage must be actively pursued.

References

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